

June 1995

EARTH OBSERVING SYSTEM

Funding Requirements for NASA's EOSDIS



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United States
General Accounting Office
Washington, D.C. 20548

Accounting and Information
Management Division

B-261133

June 8, 1995

The Honorable Robert S. Walker
Chairman, Committee on Science
House of Representatives

Dear Mr. Chairman:

This is the second product¹ in response to your request that we review the National Aeronautics and Space Administration's (NASA) Earth Observing System (EOS) Data and Information System (EOSDIS). As you requested, we have assembled a profile of estimated funding requirements for the program, based on information provided by the Office of Mission to Planet Earth (MTPE), NASA Headquarters, and the Earth Science Data and Information System (ESDIS) Project Office at the Goddard Space Flight Center (GSFC). This information was provided between November 1994 and May 1995. We did not independently verify these data. We did provide this information to NASA officials for review and have incorporated their comments where appropriate.

As discussed with your staff, we are providing this information so that advisory groups and other potential users of the system, whose participation in critical development decisions NASA has solicited, can gain a clearer understanding of EOSDIS costs. This information is contained in three appendixes to this letter.

Appendix I provides a one-page summary of EOSDIS funding administered by the Office of MTPE at NASA Headquarters. The total estimated funding for this component of EOSDIS is \$360 million through fiscal year 2000. Appendix II provides a profile of EOSDIS funding administered by the ESDIS Project Office at the GSFC exclusive of the EOSDIS Core System (ECS) contract. The total estimated funding for this component is \$1.2 billion through fiscal year 2000. In this profile, the more complex budget categories are broken out. Appendix III provides a profile of planned funding for the development of the ECS. A contract was awarded to Hughes Applied Information Systems in early 1993. The total

¹ We testified before the Subcommittee on Space and Aeronautics on March 16, 1995. See Earth Observing System: Concentration on Near-term EOSDIS Development May Jeopardize Long-term Success (GAO/T-AIMD-95-103).

funding for this contract, which runs through 2003, is estimated at \$826 million. This profile includes a detailed break-out of all of the budget categories.

EOSDIS is critical to the overall EOS Program. In addition to supporting the development and planned launch of the EOS satellites and instruments, the EOS program also funds a group of some 500 scientists competitively selected to use these instruments to study global change by analyzing long-term measurements of how the Earth functions as a single, integrated system. These scientists develop the instruments and generate the algorithms used to process the raw data into useful information as well as develop and refine integrated earth system models. EOS was first funded in fiscal year 1991 at \$17 billion through fiscal year 2000 to fly 34 unique instruments and produce some 500 data products. However, since then the program has been significantly restructured and rescopeed. Estimated program costs now total \$8.3 billion for fiscal years 1991-2000. The number of unique instruments scheduled to be flown has been reduced to 22 and the number of data products reduced to 222.

About a third of the cost for EOS will go to EOSDIS, which will operate the EOS satellites and instruments and provide the ground acquisition, processing, storage, management, and distribution of the EOS data. In addition to the EOS data, EOSDIS will incorporate and make available data from previous NASA missions, non-NASA systems, and atmosphere-, ocean-, and land-based sensors. Over its lifetime, EOSDIS could accumulate information comparable to more than 1,000 times the amount of text stored in the Library of Congress.

EOSDIS's major objective is to make this enormous quantity of data easily accessible and usable to as many as 10,000 earth scientists. It is intended to enable new modes of research about the Earth, by assisting scientists from different disciplines to work collaboratively on global change research on-line, using data sets acquired as recently as a few days earlier. EOSDIS also aims to make this data available to other users from government, academia, and public interest groups, many of whom will have little technical knowledge of satellite data. NASA is working to better define the size and extent of this broader user community, and is developing approaches to enable commercial value added extensions to the EOSDIS architecture to support it.

The heart of the EOSDIS is the ECS. This system will be responsible for distributing the satellite data to eight discipline-specific Distributed Active Archive Centers (DAACs). At the DAACs, the ECS will process the raw data into measurements that fit standard geophysical and biological parameters and store both the raw and processed data. The ECS will also provide the software interface that will enable users to search, access, and retrieve the data. ECS

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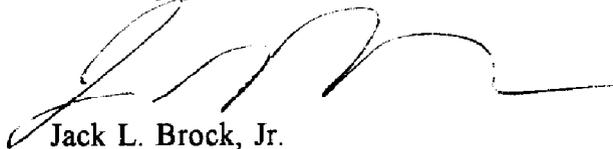
Version 1 will be implemented in steps over the 1995-1997 time frame. Subsequent versions will provide greater capacity and enhanced functions.

NASA has developed a Version 0 (V0) outside of the ECS contract as an operational prototype. V0 interconnects the old disparate data systems at the various DAACs, providing a single point of entry from which users can search and order any of the earth science data in the existing systems. "Pathfinder" data sets, large data sets collected by the National Oceanic and Atmospheric Administration (NOAA) and other agencies over a number of years, have been reprocessed and are available through V0 also. V0 came on-line in summer 1994.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this letter until 10 days from its issue date. At that time, we will send copies to the NASA Administrator and other appropriate congressional committees. We will also make copies available to interested parties on request.

If you have any questions about this letter, please contact me at (202) 512-6240. Major contributors are John de Ferrari, Elizabeth Johnston, Jamelyn Smith, and Jeffery Webster.

Sincerely yours,



Jack L. Brock, Jr.
Director, Information Resources
Management/National Security and
International Affairs

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PROFILE OF EOSDIS FUNDING ADMINISTERED BY
THE OFFICE OF MTPE AT NASA

PROGRAM OVERVIEW

BUDGET CATEGORY (dollars in millions)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
Interdis Investigators Computing Facilities (1)	\$4.9	\$9.7	\$12.8	\$14.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$41.4
Pathfinders (2)	3.1	6.6	5.7	6.7	6.2	6.3	6.6	7.0	7.4	7.8	63.4
Tech Development/Adaptation (3)	0.0	0.0	0.0	5.0	2.0	4.0	4.0	4.0	4.0	4.0	27.0
Other DIS (4)	3.4	14.8	5.5	6.2	3.7	1.0	1.1	1.2	1.2	1.3	39.4
Announcement of Opportunity (5)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	6.0
Allowance for Program Adjustment (6)	0.0	0.0	0.0	0.0	0.5	7.6	15.9	13.2	14.6	37.6	89.4
Management Taxes (7)	1.7	2.3	7.2	4.6	22.7	8.8	7.8	8.8	8.5	10.2	82.6
GLOBE (8)	0.0	0.0	0.0	0.0	1.0	0.8	0.9	0.9	1.0	1.0	5.6
Landsat 4/5 Data Purchase (9)	0.0	0.0	0.0	0.0	1.1	1.1	1.2	1.2	0.0	0.0	4.6
FY 95 Appropriation Conf-Visualization (10)	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	1.5
TOTAL	\$13.1	\$33.4	\$31.2	\$36.5	\$38.7	\$29.6	\$37.5	\$37.3	\$38.7	\$64.9	\$360.9

Source: Office of MTPE, NASA Headquarters

- (1) Provides funding for facilities for EOS-funded science investigators. As of FY 95, these funds were moved out of the EOSDIS budget into the EOS budget.
- (2) Includes algorithm and product generation of long-time series data sets relevant to global change research. These data have been collected by NOAA and other agencies and are being made available through Version 0.
- (3) NASA Research Announcement to support information systems technology research and development for EOSDIS.
- (4) Supports activities such as participation in industry-wide data and information system conferences and the annual Global Change Master Directory meeting.
- (5) Recompetition of EOS Principal Investigator awards.
- (6) Reserve funds for program contingencies.
- (7) Includes charges to program to pay for a variety of NASA overhead costs.
- (8) Inter-agency initiative to support an education program to connect the nation's schools to the National Information Infrastructure. NASA spreads funding for GLOBE throughout its programs.
- (9) NASA centrally controls the purchase of Landsat data by NASA scientists to avoid duplication of orders.
- (10) Congressionally earmarked funds.

**PROFILE OF EOSDIS FUNDING ADMINISTERED BY
THE ESDIS PROJECT OFFICE AT THE GSFC**

PROJECT OVERVIEW (exclusive of ECS Contract)

BUDGET CATEGORY (dollars in millions)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
ECS Interface (1)	\$0.0	\$0.0	\$0.7	\$2.5	\$3.3	\$3.6	\$3.7	\$3.8	\$3.8	\$4.0	\$25.4
Data Capture and Transport	0.0	6.4	3.6	24.0	57.9	63.9	57.4	67.0	69.0	64.5	413.7
Version 0 (2)	11.7	17.8	20.3	28.8	26.6	26.1	15.1	0.0	0.0	0.0	146.4
DAACs	0.0	0.2	0.0	0.0	0.0	0.0	10.1	25.0	25.2	26.7	87.1
Prototyping	0.1	0.3	1.5	1.5	3.5	4.5	7.4	9.5	10.5	10.6	49.4
Scientific Computing Facilities and Other Science Support (3)	5.7	5.2	8.9	9.7	0.9	0.6	0.8	0.6	0.6	0.7	33.5
System Integration, Test, and Independent Verification & Validation (IV&V)	0.0	0.6	0.7	5.9	10.6	11.7	10.7	9.9	9.0	9.1	68.2
Program Management and System Engineering	5.3	8.8	10.3	15.5	16.3	13.6	14.5	15.7	15.6	16.2	131.8
Contingency	0.0	0.0	0.0	0.0	18.9	35.4	49.3	41.2	41.5	48.3	234.6
TOTAL	\$22.8	\$39.3	\$46.0	\$87.9	\$138.0	\$159.4	\$168.8	\$172.7	\$175.2	\$180.1	\$1,190.1

Source: ESDIS Project Office, GSFC, NASA

(1) External to the prime ECS contract, this interface connects Hughes with non-DAAC users such as the "tire-kickers" and advisory panel members who are involved in ECS development activities.

(2) Includes "one-stop shopping" capability to search and order Earth science data held at all DAACs and operations at all DAACs. Operations started in 1991 to service users in parallel with development.

(3) Provides for computer hardware, software, and operations of the EOS-funded science investigators, and for the Science Processing Support Office at Goddard Space Flight Center. As of FY 95, Science Computing Facilities' funds which had not been already obligated were moved out of the EOSDIS budget into the EOS budget.

APPENDIX II

PROJECT DATA CAPTURE AND TRANSPORT	BUDGET CATEGORY (dollars in millions)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
	EOS Data and Operations System (EDOS) (1)	\$0.0	\$4.1	\$1.5	\$20.0	\$38.1	\$38.1	\$27.3	\$26.6	\$27.1	\$26.5	\$209.3
	EOSDIS Communications (ECOM) - Development (2)	0.0	2.3	0.8	3.0	16.3	10.8	8.8	1.0	0.5	0.5	44.0
	EOSDIS Communications (ECOM) - Operations	0.0	0.0	0.0	0.0	0.5	2.2	4.9	5.7	6.0	6.3	25.6
	Ground Stations	0.0	0.0	0.0	0.0	0.0	0.0	1.1	15.9	13.4	3.5	33.9
	Communication Lines (3)	0.0	0.0	1.3	1.0	3.0	12.8	15.3	17.8	22.0	27.7	100.9
	Internet	0.0	0.0	1.3	1.0	2.3	2.7	3.3	3.5	3.6	3.7	21.4
	DAAC-to-DAAC Communication Lines	0.0	0.0	0.0	0.0	0.7	0.4	0.4	1.0	1.1	1.2	4.8
	ECOM Circuit Costs	0.0	0.0	0.0	0.0	0.0	9.7	11.6	13.3	17.3	22.8	74.7
	TOTAL	\$0.0	\$6.4	\$3.6	\$24.0	\$57.9	\$63.9	\$57.4	\$67.0	\$69.0	\$64.5	\$413.7

Source: ESDIS Project Office, GSFC, NASA

APPENDIX II

(1) Provides for development and operation of an operational system at White Sands, New Mexico, to relay forward-link commands to EOS spacecraft, perform initial processing of spacecraft science data, and provide a backup archive for all EOS Level 0 data.

(2) Provides for the development of the operational ground-to-ground data transport system between White Sands, New Mexico, and the DAACs; includes project management and engineering, and procurement of data routers, switches, and other hardware and software required to establish the ECOM system.

(3) Provides operational communications circuits for ECOM, inter-DAAC circuits, and NASA Science Internet services to external data users and Science Computing Facilities.

APPENDIX II

APPENDIX II

PROJECT
VERSION 0

BUDGET CATEGORY (dollars in thousands)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
System Level Engineering	\$1,336	\$1,669	\$999	\$2,711	\$2,932	\$1,160	\$634	\$0	\$0	\$0	\$11,441
Data Set Development	0	0	0	260	300	110	68	0	0	0	738
Information Management System	948	1,645	1,400	1,481	1,565	860	481	0	0	0	8,380
Global Change Master Directory	300	594	658	675	600	624	389	0	0	0	3,840
Goddard Space Flight Center	3,820	4,155	4,144	3,656	3,131	3,494	2,152	0	0	0	24,552
Marshall Space Flight Center	1,340	1,933	2,388	2,001	2,225	2,175	1,462	0	0	0	13,524
Langley Research Center	640	1,100	1,286	1,436	2,175	2,191	1,397	0	0	0	10,225
Jet Propulsion Laboratory	1,890	2,410	2,955	3,230	3,356	3,060	2,032	0	0	0	18,933
EROS Data Center	1,463	3,933	1,392	3,102	3,746	3,686	2,336	0	0	0	19,658
Alaska SAR Facility	0	0	3,295	2,446	1,251	3,121	1,684	0	0	0	11,797
Oak Ridge National Laboratory	0	0	0	2,250	1,383	1,778	1,049	0	0	0	6,460
National Snow and Ice Data Center	0	206	1,506	1,710	1,863	2,169	1,439	0	0	0	8,893
RADARSAT	0	0	300	2,891	2,036	1,673	0	0	0	0	6,900
Other	0	0	0	920	0	0	0	0	0	0	920
SEAWIFS	0	110	0	0	0	0	0	0	0	0	110
TOTAL	\$11,737	\$17,755	\$20,323	\$28,769	\$26,563	\$26,101	\$15,123	\$0	\$0	\$0	\$146,371

Source: ESDIS Project Office, GSFC, NASA

APPENDIX II

PROJECT
DAACs

BUDGET CATEGORY (dollars in thousands)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
System Level Engineering	\$0	\$0	\$0	\$0	\$0	\$0	\$422	\$558	\$543	\$604	\$2,127
Data Set Development	0	0	0	0	0	0	46	119	124	129	418
Information Management System	0	0	0	0	0	0	320	840	259	268	1,687
Global Change Master Directory	0	0	0	0	0	0	260	675	702	730	2,367
Goddard Space Flight Center	0	0	0	0	0	0	1,434	3,725	4,167	4,318	13,644
Marshall Space Flight Center	0	0	0	0	0	0	974	2,727	2,960	3,078	9,739
Langley Research Center	0	0	0	0	0	0	932	2,514	2,699	2,964	9,109
Jet Propulsion Laboratory	0	0	0	0	0	0	1,354	3,528	3,686	4,051	12,619
EROS Data Center	0	0	0	0	0	0	1,558	2,981	2,514	2,708	9,761
Alaska SAR Facility	0	0	0	0	0	0	1,122	2,941	3,074	3,207	10,344
Oak Ridge National Laboratory	0	0	0	0	0	0	699	1,826	1,905	1,983	6,413
National Snow and Ice Data Center	0	0	0	0	0	0	959	2,531	2,539	2,638	8,667
EDC Facility	0	200	0	0	0	0	0	0	0	0	200
TOTAL	\$0	\$200	\$0	\$0	\$0	\$0	\$10,080	\$24,965	\$25,172	\$26,678	\$87,095

Source: ESDIS Project Office, GSFC, NASA

APPENDIX II

PROJECT
SCIENCE COMPUTING FACILITIES and OTHER SCIENCE SUPPORT

BUDGET CATEGORY (dollars in millions)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
Science Computing Facilities	\$4.7	\$3.4	\$7.8	\$8.7	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$24.6
Science Processing Support Office (1)	0.5	1.1	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	6.2
Instrument Operations Support	0.5	0.7	0.6	0.5	0.4	0.0	0.0	0.0	0.0	0.0	2.7
TOTAL	\$5.7	\$5.2	\$8.9	\$9.7	\$0.9	\$0.6	\$0.6	\$0.6	\$0.6	\$0.7	\$33.5

Source: ESDIS Project Office, GSFC, NASA

(1) Located at Goddard Space Flight Center, this office supports contractors who identify and maintain the database for science user requirements.

APPENDIX II

PROJECT
SYSTEM INTEGRATION, TEST, and IV&V

BUDGET CATEGORY (dollars in millions)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
System Integration	\$0.0	\$0.0	\$0.0	\$0.6	\$1.3	\$1.4	\$1.9	\$2.0	\$1.9	\$2.0	\$11.1
IV&V	0.0	0.0	0.0	3.5	5.7	8.3	7.4	7.9	7.1	7.1	47.0
EOS Test System	0.0	0.3	0.4	1.4	3.5	2.0	1.4	0.0	0.0	0.0	9.0
University of West Virginia (1)	0.0	0.3	0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	1.1
TOTAL	\$0.0	\$0.6	\$0.7	\$5.9	\$10.6	\$11.7	\$10.7	\$9.9	\$8.0	\$9.1	\$68.2

Source: ESDIS Project Office, GSFC, NASA

APPENDIX II

(1) Funds the development of IV&V research tools.

PROJECT
PROGRAM MANAGEMENT and SYSTEM ENGINEERING

BUDGET CATEGORY (dollars in millions)	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	TOTAL
Engineering Support	\$3.4	\$5.2	\$4.7	\$5.4	\$6.0	\$5.6	\$5.9	\$6.0	\$5.3	\$5.4	\$52.9
Performance Assurance	0.1	0.1	0.2	0.3	0.5	0.4	0.4	0.4	0.4	0.4	3.2
Resources Support (1)	0.3	0.3	0.7	1.6	1.4	1.6	1.7	1.7	1.7	1.7	12.7
Facilities Support (2)	0.0	0.1	0.6	4.9	4.5	1.4	1.4	1.1	1.1	1.1	16.2
Multi-Program Support (3)	1.5	3.1	4.1	3.3	3.9	4.6	5.1	6.5	7.1	7.6	46.8
TOTAL	\$5.3	\$8.8	\$10.3	\$15.5	\$16.3	\$13.6	\$14.5	\$15.7	\$15.6	\$16.2	\$131.8

Source: ESDIS Project Office, GSFC, NASA

(1) Includes funds for project control activities such as scheduling and configuration management.

(2) Provides funds for initial fit-out of the new EODIS building at GSFC, including the backup power generators, uninterruptable power supply, and furniture.

(3) Includes charges to pay for a variety of Center functions which support multiple programs, such as laboratories and test facilities.

PROFILE OF PLANNED FUNDING FOR THE DEVELOPMENT OF THE ECS

BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
Program Management	\$5,028.4	\$19,749.1	\$19,662.2	\$18,523.7	\$17,114.4	\$13,420.4	\$10,648.5	\$9,404.3	\$8,896.1	\$7,900.4	\$962.3	\$131,320.8
ECS System Engineering	2,805.6	7,301.0	9,910.4	7,102.0	5,885.9	3,929.9	2,561.6	2,242.4	1,840.3	1,535.7	129.6	45,244.4
FOS Development (1)	1,281.9	4,045.0	5,949.8	9,226.5	7,089.1	1,151.1	201.1	201.7	201.1	201.1	17.1	29,566.5
SDPS Development (2)	3,427.7	8,682.1	20,957.1	28,728.5	30,343.2	10,193.3	7,580.9	4,521.5	2,681.8	1,918.4	174.8	119,209.3
CSMS Development (3)	913.3	4,169.0	6,915.2	8,404.1	5,578.0	1,657.3	413.0	349.3	357.8	371.0	30.3	29,158.3
ECS Test and Evaluation	260.8	1,542.8	3,482.6	4,634.2	4,445.4	1,171.5	1,087.7	1,326.2	1,271.2	517.6	5.0	19,744.8
Performance Assurance	735.8	2,175.2	2,308.1	1,903.9	1,524.0	882.8	540.8	409.5	405.1	378.4	29.8	11,303.2
System Maintenance & Operations	1,189.5	3,112.5	4,369.3	8,325.9	18,721.5	29,489.2	37,012.1	38,817.3	40,430.7	40,691.6	3,411.8	225,551.2
Level of Effort Engineering Support (4)	0.0	1,000.0	2,400.0	4,600.0	13,700.0	15,600.0	15,000.0	7,000.0	1,000.0	1,000.0	0.0	61,257.4 *
Management Reserve (5)	0.0	0.0	0.0	13,800.0	10,000.0	8,400.0	8,000.0	8,000.0	6,000.0	5,000.0	0.0	59,226.3 *
Fee (6)	1,900.0	5,100.0	7,200.0	8,200.0	12,000.0	12,600.0	11,900.0	11,000.0	9,000.0	11,700.0	4,000.0	94,625.9 *
TOTAL	\$17,543.8	\$56,876.7	\$83,154.7	\$113,448.8	\$126,401.5	\$96,485.5	\$94,945.7	\$83,272.2	\$72,074.1	\$71,214.2	\$8,780.3	\$826,207.1

* Rows do not total due to rounding.

Source: ESDIS Project Office, GSFC, NASA

(1) Flight Operations Segment

(2) Science Data Processing Segment

(3) Communications and System Management Segment

(4) Funds which are included in the ECS contract but which are disbursed at the discretion of the ESDIS Project Office to support engineering activities such as cost studies, independent architecture studies, and pilot projects.

(5) Funds which are held by Hughes for program contingencies.

(6) Payments for the fee negotiated on the basic contract and Change Order #1.

ECS PROGRAM MANAGEMENT		FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
BUDGET CATEGORY (dollars in thousands)													
Program Control		\$690.4	\$1,696.8	\$1,534.7	\$1,282.2	\$1,269.6	\$1,253.5	\$1,249.8	\$1,248.5	\$1,235.8	\$1,244.6	\$107.6	\$12,753.5
Program Planning		403.0	518.6	947.1	1,046.7	1,018.1	946.7	696.2	502.2	373.2	259.7	22.6	6,735.1
Financial Management		374.4	1,257.5	1,513.5	1,333.4	1,321.3	1,318.6	1,174.6	950.8	897.2	847.4	50.7	11,039.4
Procurement Management		920.0	2,098.0	2,418.2	2,495.8	2,828.4	2,775.5	2,518.4	2,364.0	2,278.6	1,965.0	491.7	23,153.6
Configuration and Data Management		350.6	1,039.5	1,266.8	1,675.5	1,784.6	1,467.2	950.2	728.6	670.4	616.2	47.9	10,597.5
Science Interface and Support		650.7	2,935.1	2,558.4	2,850.0	2,899.1	1,796.3	1,182.5	1,034.0	931.2	734.4	60.0	17,429.7
Engineering Support		0.0	1,346.4	1,666.1	30.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,042.9
Facility Service Pool		1,640.3	8,916.2	7,759.4	7,809.7	6,193.3	3,862.6	2,876.8	2,576.2	2,499.7	2,233.1	201.8	46,569.1
TOTAL		\$5,029.4	\$19,749.1	\$19,662.2	\$18,523.7	\$17,114.4	\$13,420.4	\$10,848.5	\$9,404.3	\$8,866.1	\$7,900.4	\$982.3	\$131,320.8

Source: ESDIS Project Office, GSFC, NASA

ECS SYSTEM ENGINEERING												
BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
Requirements Analysis and Standards	\$900.7	\$2,312.8	\$1,242.7	\$1,341.9	\$1,191.6	\$1,152.1	\$780.0	\$664.0	\$602.7	\$550.2	\$44.9	\$10,783.6
Engineering Planning	989.9	1,744.4	4,601.3	1,876.4	1,503.0	1,182.8	908.3	837.7	566.7	554.6	50.7	14,815.8
Design and Interface Control	771.4	2,069.4	2,510.7	2,988.8	2,474.5	1,167.7	546.9	457.1	440.1	267.0	21.0	13,724.6
Design Analysis	89.0	532.4	830.0	611.3	496.3	229.8	139.7	137.4	138.2	139.8	13.0	3,356.9
Life Cycle Cost	54.6	642.0	725.7	273.6	220.5	197.5	186.7	146.2	92.6	24.1	0.0	2,563.5
TOTAL	\$2,805.6	\$7,301.0	\$9,910.4	\$7,102.0	\$5,885.9	\$3,929.9	\$2,561.6	\$2,242.4	\$1,840.3	\$1,535.7	\$129.6	\$45,244.4

Source: ESDIS Project Office, GSFC, NASA

ECS
FLIGHT OPERATIONS SEGMENT (FOS) DEVELOPMENT

BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
FOS Management	\$211.5	\$520.8	\$434.6	\$1,250.1	\$899.5	\$431.7	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$3,748.2
FOS System Engineering	324.0	1,658.1	719.4	985.4	881.3	194.7	0.0	0.0	0.0	0.0	0.0	4,772.9
FOS Prototype Development	639.4	1,478.2	520.3	18.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,654.1
FOS Development:	0.0	89.0	3,491.4	5,444.9	2,868.0	117.3	0.0	0.0	0.0	0.0	0.0	12,008.6
Telemetry	0.0	8.3	336.0	441.0	384.8	0.0	0.0	0.0	0.0	0.0	0.0	1,170.1
Command	0.0	8.3	291.7	331.8	207.3	0.0	0.0	0.0	0.0	0.0	0.0	839.1
User Interface	0.0	16.6	663.1	995.9	352.6	0.0	0.0	0.0	0.0	0.0	0.0	2,028.2
Planning and Scheduling	0.0	32.8	867.5	1,513.4	287.2	0.0	0.0	0.0	0.0	0.0	0.0	2,700.9
Data Management	0.0	7.3	357.7	641.1	532.7	44.8	0.0	0.0	0.0	0.0	0.0	1,583.6
Command Management	0.0	4.4	338.6	648.3	492.8	34.6	0.0	0.0	0.0	0.0	0.0	1,518.7
Resource Management	0.0	8.3	338.1	408.2	258.7	0.0	0.0	0.0	0.0	0.0	0.0	1,013.3
Analysis	0.0	3.0	298.7	465.2	349.9	37.9	0.0	0.0	0.0	0.0	0.0	1,154.7
FOS Integration and Test	0.0	0.0	59.4	711.2	1,692.8	75.1	0.0	0.0	0.0	0.0	0.0	2,538.5
FOS COTS	107.0	300.9	724.7	806.7	749.5	332.3	201.1	201.7	201.1	201.1	17.1	3,843.2
TOTAL	\$1,281.9	\$4,045.0	\$5,949.8	\$9,226.5	\$7,089.1	\$1,151.1	\$201.1	\$201.7	\$201.1	\$201.1	\$17.1	\$29,565.5

Source: ESDIS Project Office, GSFC, NASA

ECS
SCIENCE DATA PROCESSING SEGMENT (SDPS) DEVELOPMENT

BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
SDPS Management	\$493.4	\$804.7	\$873.9	\$1,500.2	\$1,499.9	\$833.1	\$806.0	\$808.7	\$270.5	\$0.0	\$0.0	\$7,890.4
SDPS System Engineering	1,324.6	2,596.8	3,308.2	3,061.7	2,347.8	1,086.7	839.6	860.2	893.9	0.0	0.0	16,321.5
SDPS Prototype Development	291.2	747.7	1,483.3	853.8	808.6	605.3	399.4	46.3	0.0	0.0	0.0	5,235.6
SDPS Development:	408.3	2,066.9	3,838.6	4,710.0	2,710.8	552.8	0.0	0.0	0.0	0.0	0.0	14,287.4
Client Subsystem	55.4	396.2	248.0	499.3	391.6	98.0	0.0	0.0	0.0	0.0	0.0	1,688.5
Interop. & Data Mgmt. Subsystem	0.0	0.0	295.3	502.0	468.0	117.9	0.0	0.0	0.0	0.0	0.0	1,383.2
Data Server Subsystem	31.5	238.5	1,355.7	1,346.6	603.3	111.4	0.0	0.0	0.0	0.0	0.0	3,687.0
Ingest Subsystem	0.0	349.4	369.1	221.6	21.7	0.0	0.0	0.0	0.0	0.0	0.0	961.8
Planning & DP Subsystem	321.4	1,082.8	1,570.5	2,140.5	1,226.2	225.5	0.0	0.0	0.0	0.0	0.0	6,566.9
SDPS Integration and Test	32.5	411.3	1,049.3	1,580.7	944.9	250.5	182.4	44.2	0.0	0.0	0.0	4,495.8
SDPS COTS	877.7	2,054.7	10,403.8	17,022.1	22,031.2	6,862.9	5,353.5	2,762.1	1,517.4	1,918.4	174.8	70,978.6
TOTAL	\$3,427.7	\$8,662.1	\$20,957.1	\$28,728.5	\$30,343.2	\$10,193.3	\$7,580.9	\$4,521.5	\$2,681.8	\$1,918.4	\$174.8	\$119,209.3

Source: ESDIS Project Office, GSFC, NASA

ECS
COMMUNICATIONS AND SYSTEM MANAGEMENT SEGMENT (CSMS) DEVELOPMENT

BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 200	TOTAL
CSMS Management	\$175.2	\$1,071.9	\$610.1	\$528.8	\$406.4	\$273.7	\$244.4	\$252.8	\$261.6	\$274.8	\$22.2	\$4,121.9
CSMS System Engineering	313.0	796.2	1,010.8	392.7	248.7	147.0	31.5	0.0	0.0	0.0	0.0	2,939.9
CSMS Prototype Development	115.7	348.8	635.0	194.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,294.1
CSMS Development:	130.5	1,090.6	2,714.8	3,192.5	1,090.4	89.0	0.0	0.0	0.0	0.0	0.0	8,307.8
Management Subsystem	77.7	473.8	1,240.6	816.6	352.4	49.7	0.0	0.0	0.0	0.0	0.0	3,010.8
Communication Subsystem	18.6	353.4	1,128.9	1,940.3	601.3	26.8	0.0	0.0	0.0	0.0	0.0	4,069.3
Internetworking Subsystem	34.2	263.4	345.3	435.6	136.7	12.5	0.0	0.0	0.0	0.0	0.0	1,227.7
CSMS Integration and Test	76.2	248.9	496.6	1,590.0	707.0	98.8	0.0	0.0	0.0	0.0	0.0	3,217.5
CSMS COTS	102.7	612.6	1,447.9	2,505.5	3,125.5	1,048.8	137.1	96.5	96.2	96.2	8.1	9,277.1
TOTAL	\$913.3	\$4,169.0	\$6,915.2	\$8,404.1	\$5,578.0	\$1,657.3	\$413.0	\$349.3	\$357.8	\$371.0	\$30.3	\$29,156.3

Source: ES/IS Project Office, GSFC, NASA

ECS ECS TEST & EVALUATION		FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
BUDGET CATEGORY (dollars in thousands)													
ECS System Integration and Test		\$145.2	\$885.0	\$1,855.4	\$2,014.4	\$1,146.6	\$494.0	\$535.5	\$427.2	\$525.4	\$80.3	\$0.0	\$8,109.0
System Acceptance Testing		114.9	619.0	1,562.2	2,440.3	2,248.4	368.1	499.4	491.9	600.4	144.5	5.0	9,084.1
System Test Analysis		0.5	6.7	4.7	49.4	708.2	90.1	22.8	223.9	109.3	143.0	0.0	1,358.6
Support of the IV&V Program		0.0	32.1	60.3	130.1	342.2	219.3	30.0	183.2	36.1	149.8	0.0	1,183.1
TOTAL		\$260.6	\$1,542.8	\$3,482.6	\$4,634.2	\$4,445.4	\$1,171.5	\$1,087.7	\$1,326.2	\$1,271.2	\$517.6	\$5.0	\$19,744.8

Source: ESDIS Project Office, GSFC, NASA

ECS PERFORMANCE ASSURANCE PROGRAM		FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
BUDGET CATEGORY (dollars in thousands)													
Performance Assurance Program		\$514.2	\$1,345.3	\$1,369.4	\$917.3	\$590.2	\$331.0	\$194.7	\$104.3	\$92.4	\$74.9	\$6.7	\$5,540.4
Software Assurance		150.6	517.2	639.1	677.8	678.6	420.6	228.1	181.6	185.3	168.9	14.1	\$3,861.9
Reliability Program		37.8	164.8	154.8	158.4	107.3	70.6	59.0	61.8	63.7	67.3	4.4	\$949.9
Maintainability Program		33.2	147.9	144.8	150.4	147.9	70.6	59.0	61.8	63.7	67.3	4.4	\$951.0
TOTAL		\$735.8	\$2,175.2	\$2,308.1	\$1,909.9	\$1,524.0	\$892.8	\$540.8	\$409.5	\$405.1	\$378.4	\$29.6	\$11,303.2

Source: ESDIS Project Office, GSFC, NASA

APPENDIX III

ECS
SYSTEM MAINTENANCE AND OPERATIONS

BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
M&O Management	\$1,059.4	\$2,608.0	\$3,536.4	\$5,006.6	\$6,206.6	\$5,442.3	\$5,757.1	\$5,852.3	\$5,911.4	\$5,725.3	\$431.8	\$47,539.2
Integrated Logistics Support	96.7	311.2	347.5	409.8	653.5	775.4	817.6	896.4	919.7	899.1	74.7	6,201.6
M&O Training	33.4	193.3	266.0	465.6	399.8	310.8	292.2	276.0	265.6	262.0	27.2	2,791.9
M&O Sustaining Engineering	0.0	0.0	217.4	1,360.6	4,059.9	6,473.4	6,318.3	6,607.1	8,375.7	9,626.7	796.5	43,635.6
M&O Planned Upgrades	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flight Operations (1)	0.0	0.0	0.0	299.1	1,377.1	2,519.0	2,877.1	2,881.6	2,862.2	2,736.4	285.0	15,847.5
Science Operations (1)	0.0	0.0	0.0	784.2	6,024.6	13,948.3	20,949.8	22,303.9	22,086.1	21,442.1	1,786.4	109,335.4
TOTAL	\$1,189.5	\$3,112.5	\$4,369.3	\$8,325.9	\$18,721.5	\$28,469.2	\$37,012.1	\$38,817.3	\$40,430.7	\$40,691.6	\$3,411.6	\$226,561.2

Source: ESDIS Project Office, GSFC, NASA

(1) Additional detail provided on following pages.

APPENDIX III

ECS
 MAINTENANCE AND OPERATIONS - FLIGHT OPERATIONS

BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
Flight Operations Equipment Maintenance	\$0.0	\$0.0	\$0.0	\$8.4	\$70.8	\$154.6	\$182.2	\$179.9	\$177.3	\$197.7	\$17.4	\$988.3
EOS Operations Center (EOC) Operations	0.0	0.0	0.0	186.0	834.3	1,507.8	1,716.3	1,720.6	1,711.7	1,619.7	177.2	9,473.6
Instrument Control Center (ICC) Operations	0.0	0.0	0.0	104.7	472.0	856.6	978.6	981.1	973.2	919.0	100.4	5,385.6
TOTAL	\$0.0	\$0.0	\$0.0	\$299.1	\$1,377.1	\$2,519.0	\$2,877.1	\$2,881.6	\$2,862.2	\$2,736.4	\$295.0	\$15,847.5

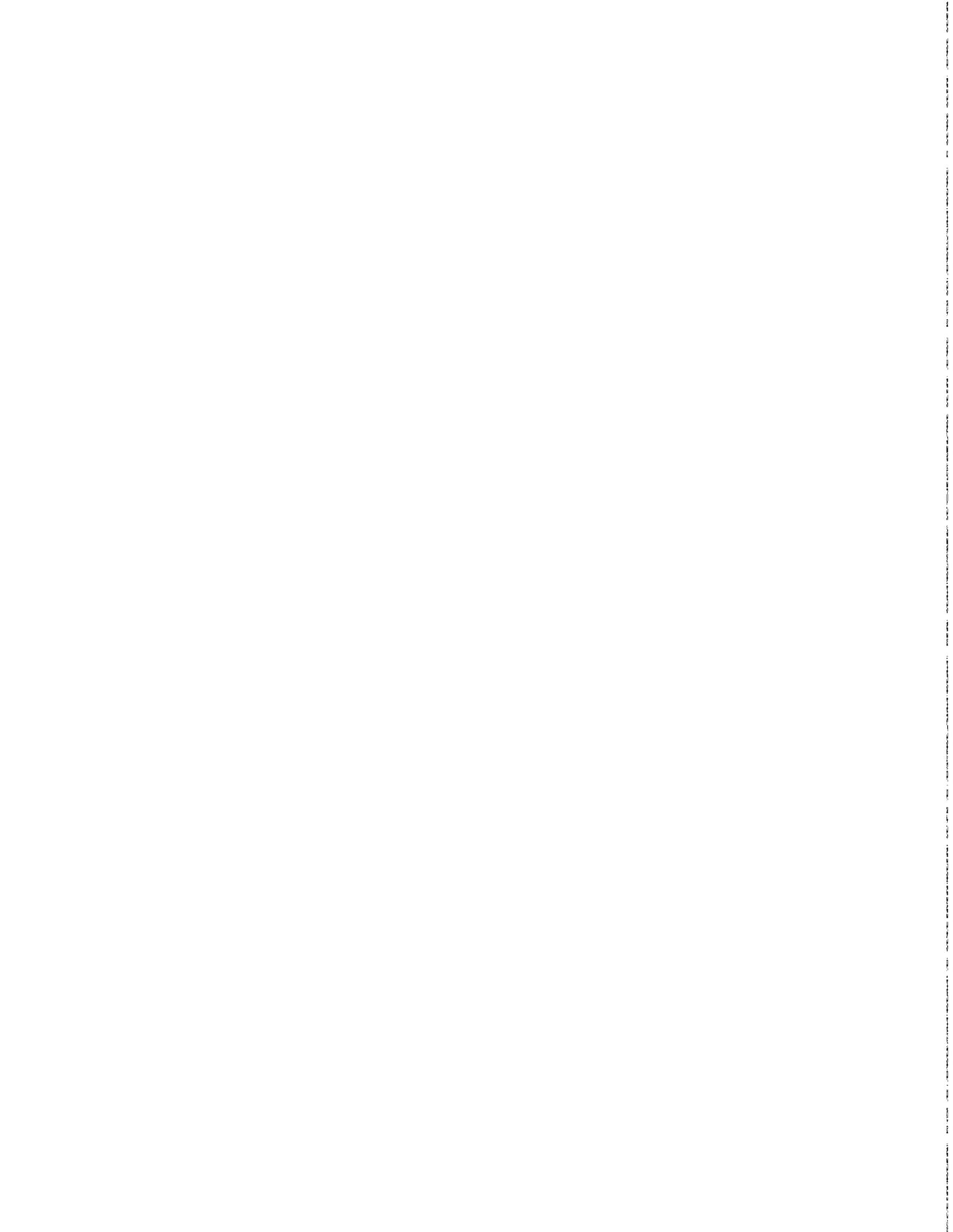
Source: ESDIS Project Office, GSFC, NASA

(511325)

ECS
MAINTENANCE AND OPERATIONS - SCIENCE OPERATIONS

BUDGET CATEGORY (dollars in thousands)	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 2000	FY 2001	FY 2002	FY 2003	TOTAL
Goddard Space Flight Center	\$0.0	\$0.0	\$0.0	\$456.7	\$2,379.1	\$5,387.7	\$8,095.0	\$8,650.9	\$8,479.9	\$8,113.9	\$671.4	\$42,234.6
Equipment Maintenance	0.0	0.0	0.0	164.0	444.8	1,150.2	1,457.2	1,503.1	1,581.5	1,821.9	160.9	8,283.6
Science Operations	0.0	0.0	0.0	14.4	463.8	2,372.0	3,209.7	3,198.3	2,884.3	2,228.6	196.9	14,588.0
CSMS Operations	0.0	0.0	0.0	278.3	1,470.5	1,865.5	3,428.1	3,949.5	4,014.1	4,063.4	313.6	19,383.0
Marshall Space Flight Center	0.0	0.0	0.0	155.4	578.0	1,430.2	1,639.0	1,665.2	1,368.1	858.3	51.7	7,745.9
Equipment Maintenance	0.0	0.0	0.0	54.9	145.1	304.5	279.6	230.1	216.8	203.4	16.1	1,450.5
Science Operations	0.0	0.0	0.0	100.5	432.9	1,125.7	1,359.4	1,435.1	1,151.3	654.9	35.6	6,295.4
Alaska SAR Facility	0.0	0.0	0.0	0.0	338.3	784.8	1,119.8	1,213.1	1,237.6	1,264.4	109.9	6,067.9
Equipment Maintenance	0.0	0.0	0.0	0.0	37.1	89.6	102.1	101.6	104.3	108.0	9.1	551.8
Science Operations	0.0	0.0	0.0	0.0	301.2	695.2	1,017.7	1,111.5	1,133.3	1,156.4	100.8	5,516.1
EROS Data Center	0.0	0.0	0.0	0.3	695.1	1,684.4	2,794.5	2,925.4	3,043.7	3,208.3	273.7	14,625.4
Equipment Maintenance	0.0	0.0	0.0	0.3	133.4	339.8	432.3	430.1	496.8	582.0	50.2	2,464.9
Science Operations	0.0	0.0	0.0	0.0	561.7	1,344.6	2,362.2	2,495.3	2,546.9	2,626.3	223.5	12,160.5
Jet Propulsion Laboratory	0.0	0.0	0.0	0.3	605.0	1,488.3	2,314.3	2,485.2	2,478.5	2,475.4	209.8	12,066.8
Equipment Maintenance	0.0	0.0	0.0	0.3	74.7	186.2	213.3	214.1	217.1	186.3	15.6	1,107.6
Science Operations	0.0	0.0	0.0	0.0	530.3	1,312.1	2,101.0	2,271.1	2,261.4	2,289.1	194.2	10,959.2
National Snow and Ice Data Center	0.0	0.0	0.0	0.3	589.1	1,443.3	2,270.8	2,415.2	2,473.8	2,474.5	212.1	11,879.1
Equipment Maintenance	0.0	0.0	0.0	0.3	74.2	187.4	268.3	268.7	283.1	235.6	21.0	1,338.6
Science Operations	0.0	0.0	0.0	0.0	514.9	1,255.9	2,002.5	2,146.5	2,190.7	2,238.9	191.1	10,540.5
Langley Research Center	0.0	0.0	0.0	171.2	840.0	1,719.6	2,716.4	2,948.9	3,014.5	3,047.3	257.8	14,715.7
Equipment Maintenance	0.0	0.0	0.0	39.4	142.8	276.4	367.8	363.8	373.0	407.6	34.8	2,005.6
Science Operations	0.0	0.0	0.0	131.8	697.2	1,443.2	2,348.6	2,585.1	2,641.5	2,639.7	223.0	12,710.1
TOTAL	\$0.0	\$0.0	\$0.0	\$784.2	\$6,024.6	\$13,948.3	\$20,949.8	\$22,303.9	\$22,096.1	\$21,442.1	\$1,786.4	\$109,335.4

Source: ESDIS Project Office, GSFC, NASA



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